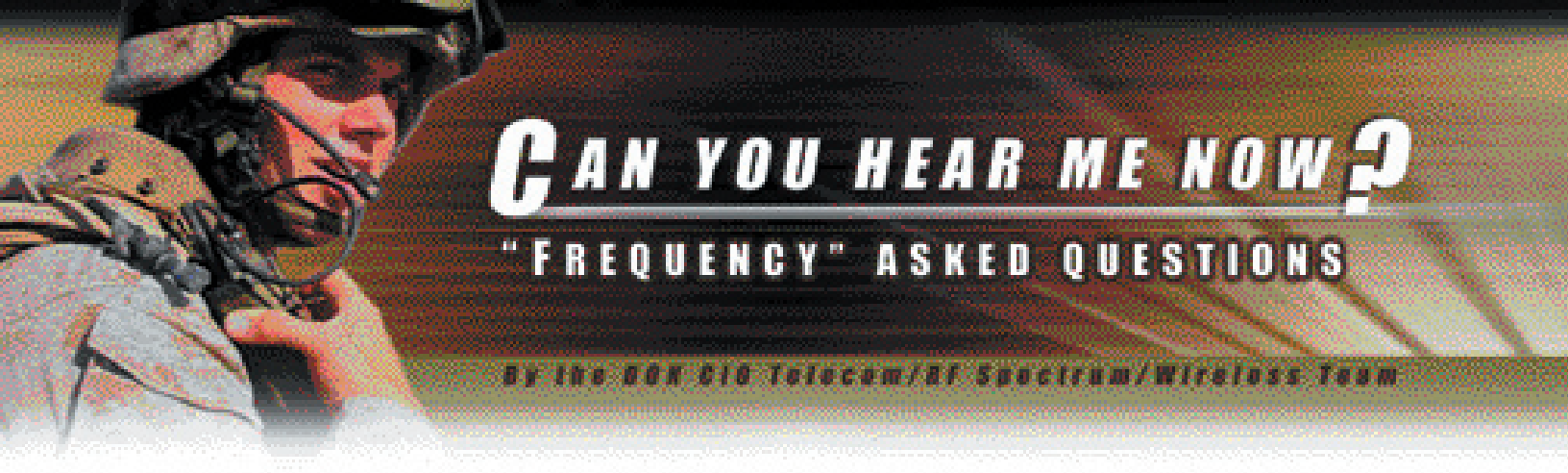


CAN YOU HEAR ME NOW?

"FREQUENCY" ASKED QUESTIONS

By the DON CIO Telecom/RF Spectrum/Wireless Team

For the past two years *CHIPS* magazine has been running the "Can You Hear Me Now" series of articles about the Department of the Navy's management of the electromagnetic spectrum. Many have followed this series and understand the fundamentals of spectrum. However, once in awhile, it is good to take a step back and look at spectrum from the novice's point of view. This article does just that and presents some frequently or "frequency" asked questions about spectrum.

What is Spectrum?

The electromagnetic spectrum, or "spectrum," is made up of all frequencies of electromagnetic waves. In the 17th century, spectrum referred to the frequencies, or colors, that made up visible light. Lower frequencies of the visible spectrum are red and higher frequencies are blue. By the end of the 19th century, scientists had discovered that the spectrum extended far beyond what we could see — above blue light was ultraviolet and X-rays, and below red light was infrared and radio waves. Gamma rays were finally discovered in the early 20th century, rounding out the electromagnetic spectrum.

Where are radio frequencies in the electromagnetic spectrum?

Radio frequencies are a subset of the larger electromagnetic spectrum. Generally, the frequencies between 3 kHz and 300 GHz are referred to as the "radio frequency (RF) spectrum." The diagram below identifies the smaller RF spectrum within the electromagnetic spectrum.

Who owns the spectrum?

The electromagnetic spectrum is a resource of each country around the globe. The governments of each country establish a system to manage, protect and regulate the use of the spectrum within their borders.

Is anyone in charge of the spectrum?

Yes and no. The International Telecommunication Union – Radiocommunication Sector (ITU-R) is an organization within the United Nations System that establishes radio regulations. These are the foundation of radio frequency regulations in most countries including the United States.

There are more than 190 member countries in the ITU; however, since the spectrum is a resource of each nation, governments are free to regulate their spectrum resources in their best interest. While the United States adopts most of the ITU-R radio regulations, some are modified to satisfy unique requirements within our country.

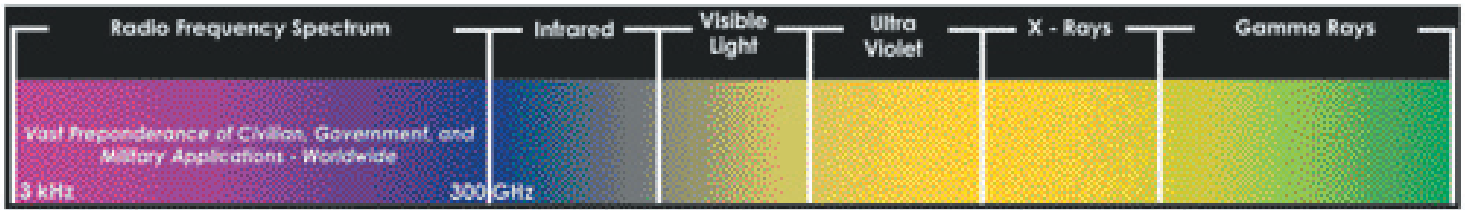
Does the Federal Communications Commission regulate the Department of the Navy's use of spectrum?

No. Within the United States there are two bodies that coordinate the regulation and planning of the radio frequency spectrum — the Federal Communications Commission (FCC) and the National Telecommunications and Information Administration (NTIA), an agency of the U.S. Department of Commerce. The FCC regulates nonfederal government use of the radio spectrum; this includes commercial users, private citizens, and state and local governments. The NTIA regulates federal government use of the radio spectrum, including the military departments.

What is spectrum management?

An overarching definition of spectrum management is: "The technical function where use of radio frequency spectrum is controlled to ensure the electromagnetic compatibility of communications-electronics systems." Within the DON, spectrum management is performed at a number of levels including the strategic, operational and tactical levels of the Navy and Marine Corps.

Figure 1. The preponderance of commercial, government and military applications worldwide are performed in these frequencies.



Which frequency band is most important to the DON?

There is no one specific frequency band that is the most important band to the Department. However, the preponderance of the frequencies used by the DON is between 30 Hz to 3 GHz. The Extremely Low Frequency (ELF) band and Very Low Frequency (VLF) band support our tactical submarine forces and other DON capabilities, while higher frequencies in the Very High Frequency (VHF), Ultra High Frequency (UHF) and Super High Frequency (SHF) bands support communications and a myriad of other DON capabilities such as unmanned aerial vehicles. Frequencies in the EHF band support critical DON satellite communications that provide immediate, worldwide communications and intelligence capabilities.

Does the DON use frequencies or have an interest in frequencies higher than the EHF band?

Yes. The DON uses infrared frequencies to support a number of Marine Corps and Navy imaging capabilities. Additionally, the DON uses visible light frequencies to support laser range finder capabilities as well as laser targeting systems. Similar to the radio frequency bands, the DON'S requirements for the use of visible spectrum are growing.

Why is the electromagnetic spectrum important to the DON?

The DON has a unique challenge among the military services since forward deployed Marine Corps forces and the fleet do not have direct access to commercial or military communications systems via landline. The only access to vital communications for forward deployed and at sea forces is via wireless links.

To ensure the Marine Corps and Navy have capable, reliable wireless communications, a broad range of the spectrum is required to support the diverse functions and global responsibilities of the naval services.

What should be in my spectrum reference library?

√ SECNAVINST 2400.1, Electromagnetic Spectrum Policy and Management – http://dodssp.daps.mil/Directives/2400_1.pdf

√ MCO 2400.2, Marine Corps Management of the Radio Frequency Spectrum - go to the Marine Corps home page at http://www.usmc.mil, click on the Publications link at the top, go to the link on the left for Orders and Directives and type "spectrum" in the search bar.

√ OPNAVINST 2400.20E, Navy Management of the Radio Frequency Spectrum – http://dodssp.daps.mil/Directives/2400e20.pdf.

√ NTIA Manual, National Telecommunications and Information Administration Manual of Regulations and Procedures for Federal Radio Frequency Management – http://www.ntia.doc.gov/osmhome/redbook/redbook.html.

√ The FCC rules, Title 47 of the Code of Federal Regulations – http://wireless.fcc.gov/rules.html.

We have enjoyed answering these fundamental questions about the electromagnetic spectrum. There is no such thing as a "dumb" question, so if you have any spectrum questions, please e-mail them to DONSpectrumTeam@navy.mil. CHIPS

ONR's Early Beginnings

Between 1946 and the founding of the National Science Foundation in 1950, the Office of Naval Research was the federal government's only agency whose principal mission was the support of basic research.

In the aftermath of World War II, Americans credited big science, pure science, with having done much to win the war. Even given the traditional American fascination with invention, progress and technology, the Second World War forced technical and scientific advance into popular thinking about defense to an unprecedented extent. People remembered Pearl Harbor and never wanted to be surprised like that again, and saw technology as a guarantor of security. Basic science shared the aura of victory.

The original permanent basic research establishment, ONR, evolved over the last 60 years into something more diversified and in some respects more accountable to its customers than its founders envisioned.

The greatest change occurred in fiscal year 1992, when the Office of Naval Technology (ONT) and the Office of Advanced Technology (OAT), separate agencies that reported to the Chief of Naval Research, were folded into ONR.

With the absorption of ONT and OAT, ONR was "reinvented" and became responsible for applied research and technology development. Since then ONR has worked to integrate the research it supports and to produce an investment portfolio that does justice to its several constituencies: Congress, the fleet, the force, industry and universities.

– Fact sheet from ONR's history page: http://www.onr.navy.mil/about/history/docs/st_invest_pov.pdf.